

# Counterproliferation



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*Dr. Burggraf applies expertise in molecular spectroscopy, surface chemistry, computational chemistry, radiation chemistry, and nuclear measurements to create new capabilities in chemical and nuclear weapons detection, environmental sensors, devices for space photovoltaics and space sensors. He has been on the faculty for since 1993 and has published over 35 technical articles and reports.*

## Research Areas

- Counterproliferation analysis
- NBC sensors and spectroscopy
- Nuclear fuels chemistry
- Nuclear radiation imaging

## Recent and Ongoing Research

Research in chemical, biological and nuclear spectroscopy is used to characterize signatures for counterproliferation target identification. Photothermal spectroscopy and IR pattern recognition have been applied to distinguish chemical agents from structurally similar pesticides. Potential for identifying microorganisms by IR volatile signatures has been demonstrated. Different spectroscopic signatures of uranium fuels have also been measured. Multiplexed Compton scatter imaging has been developed for one-sided tomography and the method is being extended to image structures surrounding gamma-emitting nuclear materials. Analysis of proliferant country fuel cycle capabilities has been conducted for both plutonium and highly enriched uranium.



*Inside View of the 25 MW(th) Reactor at Yongbyon, North Korea.*



*IR Photothermal Sensor Detects Picogram of Agent Simulant.*

## **Experimental and Modeling Facilities**

State of the art departmental facilities range from nuclear radiation measurement laboratories using high-resolution detectors and imaging arrays to molecular spectroscopy laboratories having infrared, Raman and photoluminescence spectroscopies. Chemistry and biology characterization labs are also available. Modeling is done using a network of workstations. For large computational requirements, the world class ASC Major Shared Resource Center provides access to state of the art parallel processing capabilities and visualization tools.



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*Major Jodoin's research interests center around nuclear weapon effects and countering nuclear weapon proliferation. He has served on the Engineering Physics faculty since 1999 and is currently the chair of the Nuclear Engineering Curriculum Committee. Major Jodoin has been associated with nuclear weapon issues since 1985 and previously taught at the U.S. Air Force Academy.*